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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Ehud ELNATAN et al.

Title: APPARATUS FOR MEASURING THE WEIGHT OF SMALL ITEMS

Appl. No.: 10/670,506

Filing Date: 09/25/2003

Examiner: Unassigned

Art Unit: Unassigned

CLAIM FOR CONVENTION PRIORITY

Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

Sir:

The benefit of the filing dates of the following prior foreign applications filed in the following foreign country is hereby requested, and the right of priority provided in 35 U.S.C. § 119 is hereby claimed.

In support of this claim, filed herewith are certified copies of said original foreign applications:

- ISRAEL Patent Application No. 151,994 filed 09/29/2002.
- ISRAEL Patent Application No. 153,544 filed 12/19/2002.

Respectfully submitted,

Date January 22, 2004

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משרד המשפטים
לשכת הפטנטים

This is to certify that annexed hereto is a true copy of the documents as originally deposited with the patent application of which particulars are specified on the first page of the annex.

זאת לתעודה כי רצופים בזה העתקים נכונים של המסמכים שהופקדו לכתחילה עם הבקשה לפטנט לפי הפרטים הרשומים בעמוד הראשון של הנספח.

This 12-10-2003 היום

מ. לסרי
ממונה על הבוחנים

רשם הפטנטים
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חוק הפטנטים התשכ"ז -1967
PATENTS LAW, 5727-1967

בקשה לפטנט
Application for Patent

לשימוש הלשכה
For Office Use

מספר: Number	151994
תאריך: Date	29-09-2002
הוקדם/נדחה Ante/Post-dated	

אני, (שם המבקש, מענו – ולגבי גוף מאוגד – מקום התאגדותו)
I (Name and address of applicant, and, in case of a body corporate, place of incorporation)

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בעל אמצאה מכח הדין ששמה הוא:
Owner, by virtue of of an invention, the title of which is:

(בעברית) (Hebrew)
פינצטה שוקלת ושיטה לשימוש בה

(באנגלית) (English)
WEIGHING FORCEPS AND METHOD FOR USE THEREOF

המצאים: אהוד אלנתן, יובל ליצ'י, שי פופר ויוסי שומר
Inventors: Ehud Elnatan, Yuval Lichi, Shay Popper, Yossi Shomer

מבקש בזאת כי ינתן לי עליה פטנט.
hereby apply for a patent to be granted to me in respect thereof.

* בקשת חלוקה - Application for Division	* בקשת פטנט מוסף Application for Patent of Addition	* דרישת דין קדימה Priority Claim		
		מספר/סימן Number/Mark	תאריך Date	מדינת האיגוד Convention Country
* מבקשת פטנט from Application No. מס' Dated מיום	* לבקשה / לפטנט To Patent/Appl. No. מס' Dated מיום			
* יפוי כח: כללי/מיוחד – רצוף בזה / עוד יוגש P.O.A.: general / specific - attached / to be filed later -				
Has been filed in case הוגש בענין				

המען למסירת הודעות ומסמכים בישראל
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ד"ר מאיר נועם
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טל. 02-6518880 פקס. 02-6523336

חתימת המבקש
Signature of Applicant

היום 200 בחודש שנת
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לשימוש הלשכה
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מרגוט גנץ
בכירה לרשם הפטנטים

טופס זה, כשהוא מוטבע בחותם לשכת הפטנטים ומושלם במספר ובתאריך ההגשה, הינו אישור להגשת הבקשה שפרטיה רשומים לעיל.
This form, impressed with the Seal of the Patent Office and indicating the number and date of filing, certifies the filing of the application, the particulars of which are set out above.

* מחק את המיותר Delete whatever is inapplicable

פינצטה שוקלת ושיטה לשימוש בה

WEIGHING FORCEPS AND METHOD FOR USE THEREOF

FIELD OF THE INVENTION

The present invention generally relates to weighting forceps. More specifically, the present invention relates to handheld forceps having means to both grasp and simultaneously measure the mass of small solid particles, such as diamonds and precious stones,

BACKGROUND OF THE INVENTION

Various objects are needed to be weighed in order to determine their value, price; for the sake of categorizing it in a predetermined scale etc. Those objects are traditionally collected in a first step and only then the objects are weighted in a second step by means of weighted scales or pan balances. While this daily used technique is convenient when relatively large objects are to be weight, a routine collection of small objects is tedious and time-consuming. Moreover, weighting fine and/or small objects, as such as diamonds, precious or semi-precious stones and metals is especially of great industrial applicability due to the correlation between the weight of the object and its value. In spite of the aforementioned needs, only few approaches were taken in the art in order to provide useful and convenient means to determine the appellative value of said object.

U.S. Pat. No. 6,397,678 to the applicant describes method and apparatus for measuring the mass of individual objects, e.g., diamonds, by conveying the diamonds towards an oscillatable probe having a predetermined mass and a vacuum port of smaller dimensions than those diamonds. Vacuum is hence the driving force for the diamonds to be attracted to the apparatus before their measurement.

SUMMARY OF THE INVENTION

It is thus the primary object of the present invention to provide forceps, characterized by having means for weigh an object at the time said object is fastened by said forceps.

It is in the scope of the present invention to provide the forceps defined above, comprising forceps having means for fasten an object, and means for weigh said object, comprising display and rigid envelope accommodating the same. The object to be weigh is fastened according one embodiment of the present invention by at least two pincers of the forceps, especially in the manner a push-button is mechanically pressing at least one of said pincers.

It is also in the scope of the present invention, wherein the aforementioned forceps is having (a) forceps comprising at least a first pincer and a second pincer; (b) a push-button assembly. Said Push-button assembly is preferably comprising (1) a push-button located adjacent to the outer envelope of said weighting forceps; (2) a member adapted to be communication with the said push-button and with the first pincer; and (3), a retrieving spring. According to said embodiment, said push-button is adapted to press pincers selected from the first pincer and the second pincer, by means of said member so the forceps are open and fasten the object to be weigh.

It is also in the scope of the present invention, wherein the aforementioned forceps is having (a) a rigid envelope; (b) forceps having a proximal and distal portion, said proximal portion is located outside the said envelope and adapted to fasten effectively a selected object; said distal portion are accommodated inside said envelope; (c) an exciting solenoid located adjacent to the distal portion of the forceps, adapted to hit the forceps in predetermined movement and thus to vibrate the forceps to a analyzable vibration characteristics; (d) an oscillator activating to said solenoid; (e) an electric power source selected from a DC battery or any other AC/DC power source; (f) a detection assembly having means for gather input data; (g) a micro-controller adapted to operate the data and accurately translate said detected parameters into predetermined outputs; and (h) a projection unit having means for project output data.

The aforementioned detection assembly is preferably comprising a light emitter; a detector; and a plurality of optical fibers adapted to transfer light to the vibrated forceps and in return, to transfer collected light inputs to said detector.

It is further in the scope of the present invention, wherein the processing unit is adapted to translate said light inputs to a predetermined scale, and wherein the light emitter is LED.

According to another embodiment of the present invention, said forceps comprising the following ingredients: (a) a rigid envelope; (b) forceps having a proximal and distal portion, said proximal portion is located outside the said envelope and adapted to fasten effectively a selected object; said distal portion are accommodated inside said envelope; (c) exciting piezoelectric cell located adjacent to the distal portion of the forceps, adapted to hit the forceps in predetermined movement and thus to vibrate the forceps to a analyzable vibration characteristics; (d) an oscillator activating to said solenoid; (e) an electric power source selected from a DC battery, photovoltaic cells or any other AC/DC power source; (f) a ceramic piezoelectric detecting cell having means to gather input data; (g) a processing unit adapted to accurately translate said detected input data into predetermined output data; and (h) a projection unit having means to project said output data.

It is a particulate embodiment of the present invention, wherein the objects to be collected and weighted are selected from, yet not limited to diamonds, precious and semiprecious stones, precious and semiprecious metals.

It is also in the scope of the present invention, wherein the detected data is translated to predetermined mass scale, weight scale, carats or points. In addition, it the present invention preferably comprising means to project the detected or translated data is selected from a sound or voice indication; a buzzing signal, vibrating signal, light indications, or a remote indication.

BRIEF DESCRIPTION OF THE FIGURES

In order to understand the invention and to see how it may be carried out in practice, a preferred embodiment will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Figure 1 schematically presents a cross section of handheld weighting forceps comprising a solenoid.

Figure 2 schematically the proximal portion of the forceps adapted to hold (Fig. 2A) or release (Fig. 2B) the weighted object.

Figure 3 schematically presents a cross section of weighting forceps comprising a piezoelectric means to vibrate the pincers and means to close & open the forceps.

Figure 4 schematically presents various embodiments of the proximal portion of the forceps.

Figure 5 schematically presents a block diagram of the microprocessor's inputs and outputs.

DETAILED DESCRIPTION OF THE INVENTION

The term weighting forceps is referring, according to the present invention, to forceps, clamps, vise, tweezers, or any fastening tools having means to weigh objects at the time the object is fastened by said tool. More specifically, this term is referring hereto to weighting forceps, adapted to the diamonds and the jewelry industries. In this embodiment, precious or semi-precious stones are routinely collected and than weighted to determine their value, as well as their physical characteristics. Nevertheless, those weighting forceps are also adapted to collect and to weight any other solid or partially solid particles, such as medicaments, food ingredients, or any objects to be determined, measure, evaluated by means of its mass. The term 'mass' is simultaneously referring in the present invention to physical parameters selected from mass, particularly weight, heaviness, density, specific gravity, bulk gravity, etc.

Aforementioned weighting forceps are weighting the fastened objects by various techniques known in the art, such as spring based mechanisms, an oscillatable probe having a predetermined mass etc.

According to one preferred embodiment of the present invention, an oscillatable probe having a predetermined mass is used in the manner objects to be weighted are fastened by the forceps, and the oscillating frequency of the oscillatable probe is measured so the mass of the object is calculated. After releasing the object from the forceps, the probe is automatically prepared to measure the mass of another one of the individual objects is.

According to further features in the described preferred embodiments, the probe includes a piezoelectric device. In one described preferred embodiment, the piezoelectric device generates an electrical output, which is in correlation with the vibration of the forceps. Said electrical output is at the oscillating frequency measured and utilized to compute the mass of the individual object.

In another described embodiment, the piezoelectric device is driven at a first frequency which frequency is changed by the mass of the object when attracted to the forceps, the change in frequency being measured and utilized to compute the mass of the individual objects attracted to the vacuum port.

According to further features in the described preferred embodiments, the oscillating frequency of the probe is measured after a predetermined time delay after forceps are been hit by the oscillator.

Reference is made now to figure 1A presenting a schematic cross section of one preferred embodiment of a handheld weighting forceps according to the present invention. An object, such as a diamond, is fastened by the pincers of the forceps (1a), in the manner a push button (2) is pressing at least one of said pincers by means of a member (2a). Said member is in communication in one side with the push button (2) and with one pincer on the opposite side. The member (2a) is penetrating the other pincer throughout an opening (2b). The push-button is in communication with a spring (2c), held by the envelope (3) of the device. The forceps accommodate inside the device comprises a proximal portion (1a) and a distal portion (1b). The proximal portion (1a) comprises at least one upper pincer (1u) and at least one lower pincer (1l), thus adapted to effectively fastening the selected object to be weight. The pincers are been associated to one member (1b) in the distal portion of the forceps, wherein the forceps are immobilized to the device. This immobilization is provided

preferably by means of plurality of screws (as such as 1c) or by other means, such as glue, entrapment in the body of the device (5) etc.

An exciting solenoid (4), located in the inner body (5) of the device, is in communication with the distal portion of the forceps, by means of an oscillator. Said oscillator is connected to a DC battery (6) and potentially to any other AC/DC power source (not shown). Upon predetermined operation procedure of said solenoid (4) the oscillator is hitting the forceps in predetermined movement, so the proximal portion of the forceps (1a) is vibrated. Optical fibers (7) are in communication with a light emitter device and light detector (9). A mirror and/or a plurality of mirrors (8) are directed towards said forceps and transfer light to said vibrated forceps. Optic fibers (7) are also collecting light inputs *via* a detector (9), to a processing unit, such as a microprocessor (100), adapted to accurately translate said light inputs into a mass scale, determining the weight of the collected object. Said mass scale may be calibrated in term of weight units (e.g., milligrams, ounces etc), carats, points etc and may be displayed in a screen (50), such as the one presented in figure 1B, which is showing a schematic side view of the handheld weighting forceps.

Reference is made now to figure 2A, presenting the forceps as defined above, wherein the pincers (1a) are at their 'close' orientation wherein the push-button (2) is released by means of spring (2c) in the movement (2e). Figure 2B show the same forceps wherein the push-button (2) is pressed in the direction (2d), so the lower pincer is pushed down and the object (20) is released.

Reference is made now to Fig. 3A presenting a somewhat similar handheld weighting forceps according to another embodiment of the present invention, wherein an exciting piezoelectric cell (4) is vibrating the forceps (1b) by means of the oscillator defined above. The said vibration is detected by a ceramic piezoelectric cell (7), having means to read the vibrating signal and translating it predetermined mass scale.

The forceps defined above comprising a mechanical system that provides for a somewhat different operation. Here, the object to be collected and to be weigh (20) is fastened by the pincers (1a, here the lower pincer) only at the time push button (2) is pressed in the direction (2d). The pressed push button (2) is pressing then a spring (2c). According to one embodiment (not shown) the said forceps are comprising a retrieving spring. By releasing

said push button (2) in the movement (2e), spring (2c) is released, so the upper pincer is forced to be elevated, the forceps are opened and the weighted object (20) is substantially released.

Figure 4 schematically presents few possible embodiments of the present invention, though it is acknowledged that other embodiments are possible. Fig. 4A shows a side view of the proximal portion (1a) of the pincers. Said two pincers ended with a plate like members, having respectively high surface area, wherein the object (20) is held between said at least two members. Fig. 4B schematically presents a cross section of the proximal portion (1a) of the pincers, wherein the object (20) is held in a pocket provided by at least a proximal wall (1g) and a distal wall (1h) in communication with lower pincer. The upper pincer is adapted to fasten the object whereat the forceps are in a closed configuration. Fig. 4C schematically presents an embodiment wherein said forceps comprises only one vertical pincer (1a), and at least two ascending pincer-like members (1i and 1j). Preferably, members 1i and 1j are forming V or U shape pockets, adapted to effectively yet reversibly fastening the object (20) to be weighted. Said members 1i and 1j may be made of rigid or flexible materials. It is also in the scope of the present invention in this respect that said one-pincer structure may be characterized by either a spoon or fork like structures.

Reference is made now to figure 5, schematically presenting a block diagram of the weighting process. A micro-controller (100) is gathering information from a keyboard (101) or an RS-232 interface (102), USB or any other interface. It is acknowledged in this respect that the scope of this invention also relates to any suitable interface (102) having means to communicate between data terminal equipment and data communications equipment employing serial binary data interchange. Data processed by said microprocessor (100) is transferred to a buffer (103), and than to either the Piezoelectric cell (104), the solenoid transmitter (104) Piezocaremic cell or any alternative means for the same. The pincers of the said forceps (1a, see figures 1-) are mechanically now fastening the object to be weight (20 see figures 2a, 3a and 4a-c), wherein in addition feedback information is sent to the micro-controller (100). Subsequently, an optic detector (e.g., piezoelectric or electric devices, 111) are producing a pre-processing signal (112), sent to the micro-controller (100). Therefore, a plurality of output indications may be resulted, such as voice indication, e.g., by means of a buzzer (105), light indications, such as light emitting by LCDs (106) or LEDs, remote indications (not shown) etc. According to one embodiment of the present

invention, the display comprises a plurality of digits, preferably about 6 digits of 11 segments or graphic display. Said data acquiring and processing is enabled by a power management unit (120), selected, yet not limited to rechargeable battery, charger, backup battery, battery pack, photovoltaic (PV) cells etc.

Thus, it is also in the scope of the present invention to provide a useful method of collecting the selected object by forceps. The core of said method is measuring the mass of said object by vibrating it and measuring the frequency of the obtained vibrations. Said method comprises the following steps. In the first step, the object is fastened by forceps towards an oscillatable probe, having a predetermined mass. In a second step, the said object is vibrated by means of said osicllatable probe. Later, means are taken to measure for a predetermined time interval the oscillating frequency of said oscillatable probe while the individual object attracted thereto is held by the forceps. In a subsequent step, the measured oscillating frequency of the probe and said object attracted thereto is analyzed to compute the mass of said object.

CLAIMS

1. Forceps characterized by having means for weigh an object at the time said object is fastened by said forceps.

2. The forceps according to claim 1 comprising;
   a. pincers connected to each other at their distal portion, having means for fastening an object;
   b. means for weighing said object at the time said object is fastened by said pincers.

3. The forceps according to claim 1, wherein the object is diamond.

4. The forceps according to claim 1 or any of its preceding claim, wherein the means for weighing the object comprises;
   a. a vibrator having means for vibrating the pincers of the forceps; and
   b. means to determine the mass of said vibrated pincers.

5. The forceps according to claim 2, wherein the pincers comprising a proximal portion and distal portion; said proximal portion adapted to collect and to fasten an object, and said distal portion is anchored to a rigid envelope.

6. The forceps according to claim 5, comprising a first pincer, a second pincer and push-button assembly; wherein the said push-button assembly is characterized by
   a. a push-button perturbing the outer envelope;
   b. a plug member in communication with said push-button and with one of the pincers; and
   c. a spring;

   and wherein said push-button is adapted to pull or push the pincer by means of said plug member so the forceps are opened and ready to fasten an object to be weighed.

7. The forceps according to claim 2 comprising;
   a. a rigid envelope;
   b. pincers having a proximal and distal portion, said proximal portion is located outside the said envelope and adapted to fasten effectively a selected object; said distal portion is effectively anchored in said envelope;

c. an exciting solenoid located adjacent to the distal portion of the forceps, adapted to hit the forceps in predetermined movement and thus to vibrate the forceps to a analyzable vibration characteristics;

d. an oscillator activating to said solenoid ,

e. an electric power source selected from a DC battery or any other AC/DC power source;

f. a detection assembly having means for gather input data; and

g. a microprocessor adapted to operate the data and accurately translate said detected parameters into predetermined outputs.

h. a projection unit having means for project output data.

8. The forceps according to claim 6, wherein the detection assembly comprising;

a. a light emitter;

b. a detector;

c. a plurality of optical fibers adapted to transfer light to the vibrated forceps and in return, to transfer collected light inputs to said detector.

9. The forceps according to claim 6, wherein the processing unit is adapted to translate said light inputs to a predetermined scale.

10. The forceps according to claim 7, wherein the light emitter is LED.

11. The forceps according to claim 2 comprising;

a. a rigid envelope;

b. pincers having a proximal and distal portion, said proximal portion is located outside the said envelope and adapted to fasten effectively a selected object; said distal portion in anchored inside said envelope;

c. exciting piezoelectric cell located adjacent to the distal portion of the forceps, adapted to hit the forceps in predetermined movement and thus to vibrate the forceps to a analyzable vibration characteristics;

d. an oscillator activating to said solenoid,

e. an electric power source selected from a DC battery, photovoltaic cells or any other AC/DC power source;

f. a ceramic piezoelectric detecting cell having means to gather input data;

g. a microprocessor adapted to accurately translate said detected input data into predetermined output data; and

i. a projection unit having means to project said output data.

11. The forceps according to claim 1 and any of the preceding claims adapted for collecting and weighting objects selected from diamonds, precious and semiprecious stones, precious and semiprecious metals.

12. The forceps according to claim 2 and any of the preceding claims, wherein the detected data is translated to predetermined mass scale, weight scale, carats or points.

13. The forceps according to claim 2 and any of the preceding claims, wherein at least one pincer is connected in its proximal portion to means for accommodating the selected object.

14. The forceps according to claim 13, wherein said means is selected from plate-like members, spoon-like members, fork-like members, V-pocket members or U-pocket members.

15. The forceps according to claim 14, comprising only one pincer.

16. The forceps according to claim 11, wherein the means to project the detected or translated data is selected from a graphic or numeric projections, sound or voice indication; a buzzing signal, vibrating signal, light indications, a remote indication or any combination thereof.

17. The weighting forceps according to claim 11, wherein the light indications are provided by means of displaying said data by a plurality of digits or graphic LCD or any other output of display.

18. The forceps according to claim 11, wherein the remote indications are selected from at least one of the group of transferring light, RF, electric or magnetic massages to a remote display.

19. The forceps according to claim 11, wherein the transferred massaged is provided by Internet, intranet, or optic means.

20. The forceps according to claim 11, wherein the remote display is selected from a database, computer, screen display or a sound emitter.

21. The forceps according to claim 2, wherein the object to be weigh is collected or fastened by a spoon like member.

22. The forceps as illustrated in Figure 1.

23. The forceps as illustrated in Figure 2.

24. The forceps as illustrated in Figure 3.

25. The forceps characterized by a proximal portion as illustrated in Figure 4.

26. A method for measuring the mass of objects by means of the forceps as defined in claim 1 or in any of the preceding claims, comprising:
    a. fastening said object by forceps;
    b. measuring the mass said object;
    c. releasing said forceps to release said object; and
    d. displaying the said measured mass or weight of said object.

27. The method according to claim 26, comprising;
    a. fastening the object by forceps towards an oscillatable probe, having a predetermined mass;
    b. vibrating said object by means of said osicllatable probe;
    c. measuring for a predetermined time interval the oscillating frequency of said oscillatable probe while the individual object attracted thereto is held by the forceps;
    d. analyzing the measured oscillating frequency of the probe and said object attracted thereto to compute the mass of said object;

e. releasing said forceps to release said object preparatory to using said probe to measure the mass of another one of said individual objects and displaying the said measured mass of said object.

28. The method according to claim 26, wherein the fastening of the object by the forceps is provided by pressing a push button.

29. The method according to claim 26, wherein the fastening of the object by the forceps is provided by releasing a previously pressed push button.

30. A method for weighting objects collected by the forceps according to claim 1 or any of the preceding claims, comprising;

a. collecting the selected object by forceps;
b. measuring the mass of said object;
c. transferring said measured date to a micro-controller;
d. processing said data by a micro-controller;
e. transferring said data to either a piezoelectric cell or a solenoid transmitter;
f. fastening a selected object with the forceps;
g. transferring a feedback information to the said micro-controller;
h. producing a pre-processing signal by an optic detector selected from piezoelectric or electric devices;
i. transferring said data to the micro-controller; and
j. projecting a plurality of processed data on a display.

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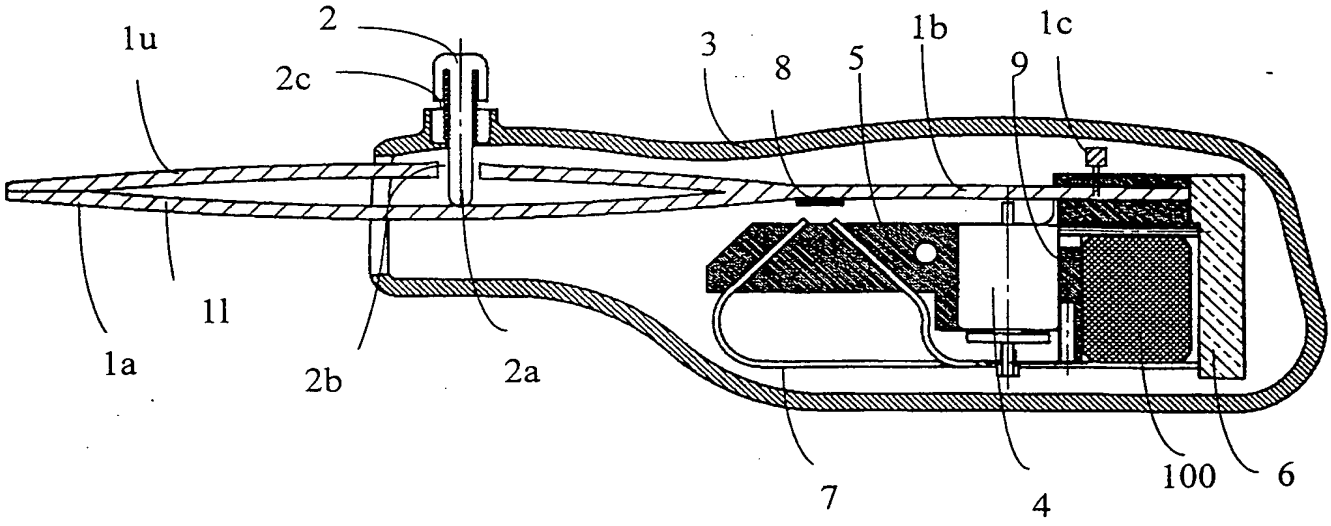
FIGURE 1



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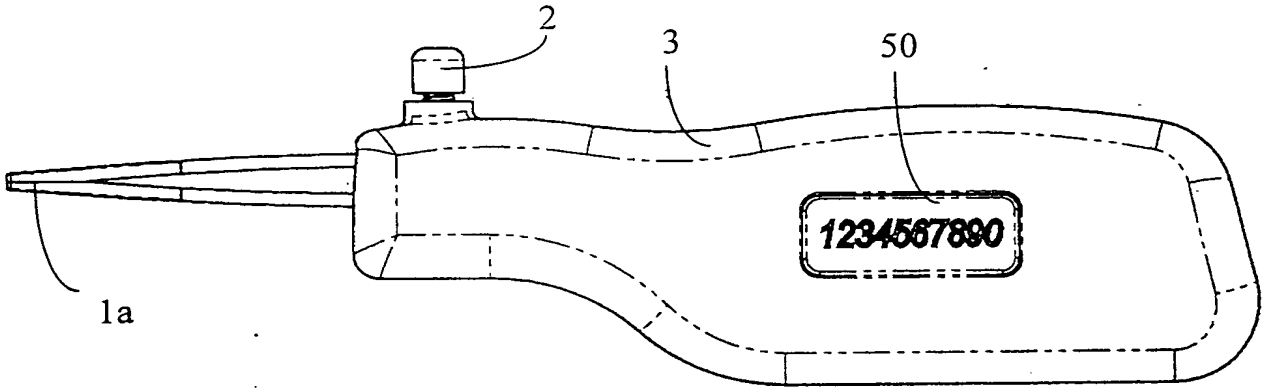
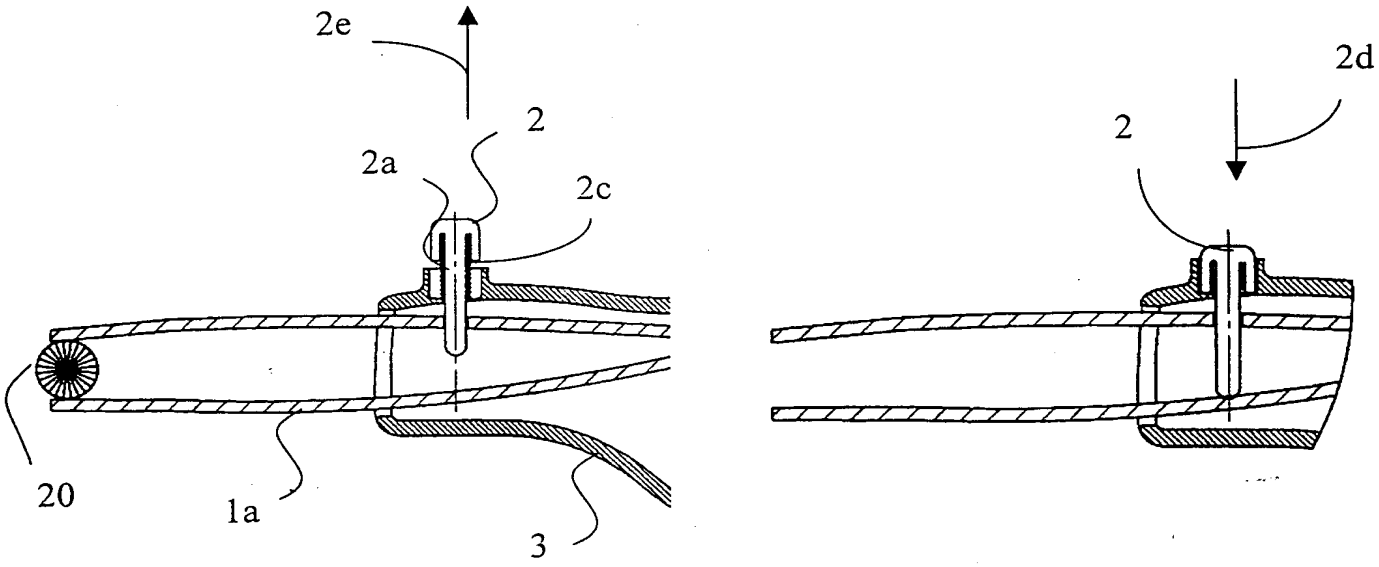


B

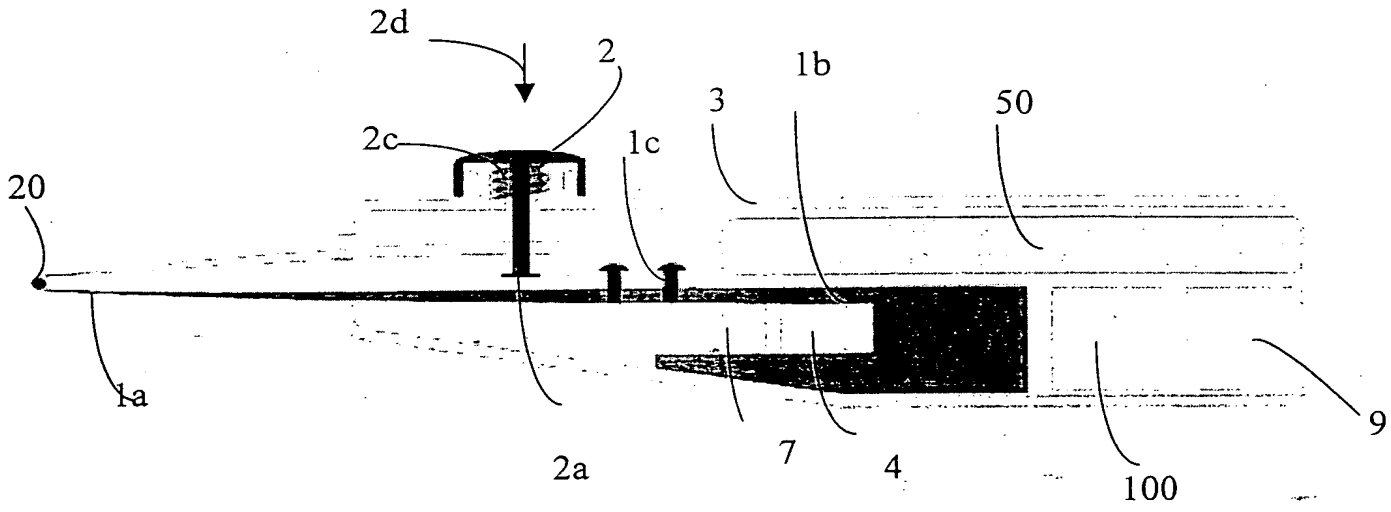
FIGURE 2



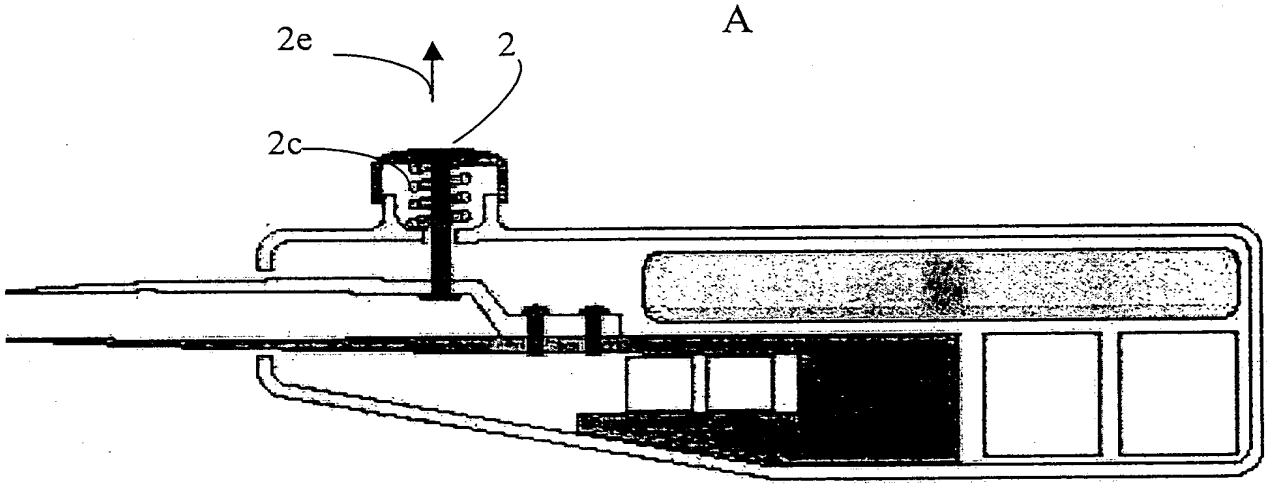
A

B

FIGURE 3

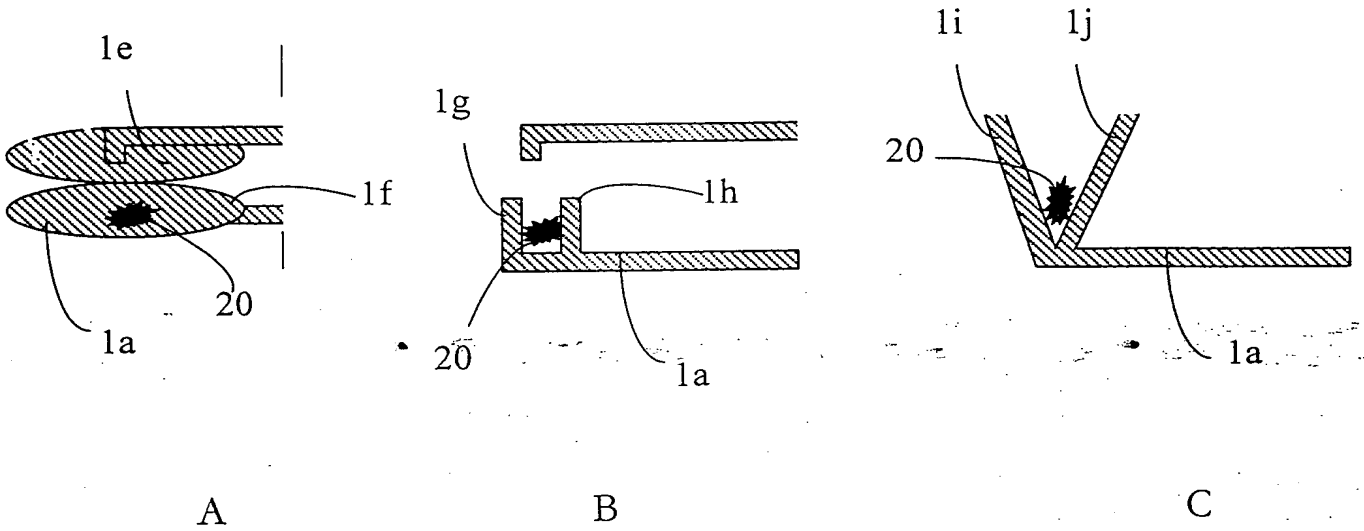


A



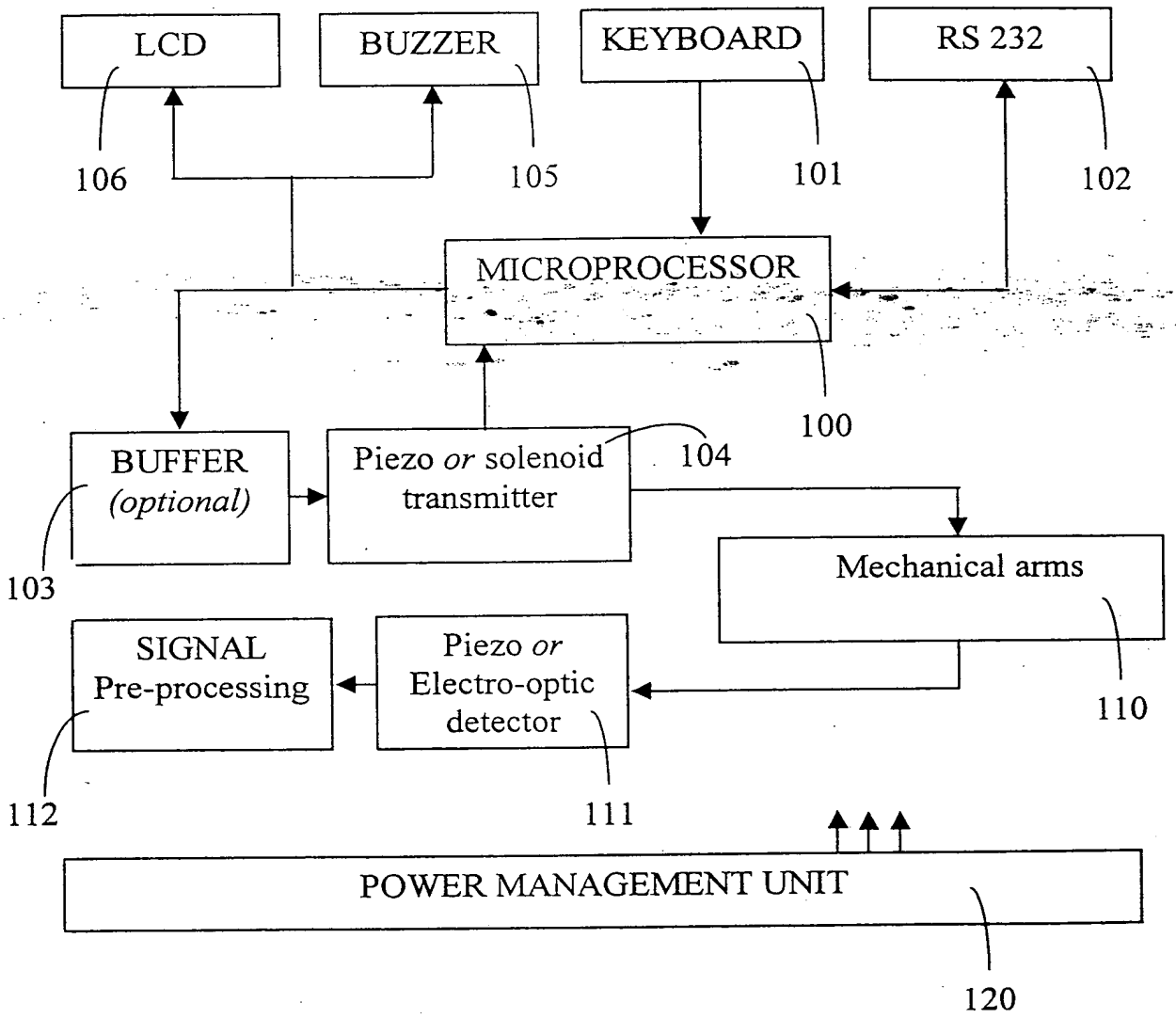
B

FIGURE 4



A B C

FIGURE 5


LCD
BUZZER
KEYBOARD
RS 232
106
105
101
102
MICROPROCESSOR
100
BUFFER
(optional)
Piezo or solenoid
transmitter
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